EXAMINER'S AMENDMENT & STATEMENT OF REASONS FOR ALLOWANCE

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Amendments & Claim Status

[1] This Examiner's Amendment is responsive to the telephone interview dated May 11, 2009. Claims 1-4, 6-8, 10-14, 19, 20, 23 and 25-30 remain pending.

[2] An examiner's amendment to the record appears below. Should the changes and/or additions be unacceptable to applicant, an amendment may be filed as provided by 37 C.F.R. § 1.312. To ensure consideration of such an amendment, it MUST be submitted no later than the payment of the issue fee.

[3] Authorization for this examiner's amendment was given in a telephone interview with Tom Kocovsky (Reg. No. 28,383) on May 11, 2009.

Amendment to the Claims

1. (Currently Amended) A method comprising:

acquiring first modality image data while an imaged object moves over a range of motion and reconstructing the first modality image data into a motion artifacted first modality image, the first modality image being one of a positron emission tomography (PET) image or a single positron emission computed tomography (SPECT) image;

acquiring second modality image data and reconstructing the second modality image data into second modality images which represent the object in respective states of motion with as few motion artifacts as possible, the second modality images being one of computed tomography (CT) images and magnetic resonance (MR) images;

from the second modality images, determining a motion model which characterizes states of motion assumed by the object while moving through the states of motion;

forming an intermediate image of the object from the motion model and the second modality images, the intermediate image representing the object as if it had moved during the acquiring of the second modality image data over the range of motion over which the object moved as the first modality imaging data was acquired, forming the intermediate image includes:

forming other images of other states of motion of the object from the second modality image data;

weighting and subsequently superimposing the other images and the second modality images in conformity with a frequency at which each of the other states of motion were assumed by the object while moving over the range of motion while the first modality image data was acquired;

forming a combination image from the intermediate image and the first modality image.

2. (Currently Amended) A method of enhancing a first image of a moving object, the first image containing motion artifacts, the first image being a positron emission tomography (PET) image or a single positron emission computed tomography (SPECT) image, the method including:

a. acquiring further images that represent the object in respective states of motion with as few motion artifacts as possible, the further images being one of computed tomography (CT) images and magnetic resonance (MR) images;

b. from the further images, determining a motion model that characterizes the states of motion assumed by the object;

c. forming additional images of others of the states of motion of the object from the further images and the motion model;

d. weighting and subsequently superimposing the other images and the second modality images in conformity with a frequency at which each of the other states of motion were assumed by the object while moving over the range of motion over which the first modality image data was acquired; and

e. focusing the first image by means of the motion model.

3. (Currently Amended) A method of enhancing information contents of a first image of a moving object, to be reconstructed from projections acquired as the object moves over a plurality of states of motion and containing motion artifacts, the first image being a positron emission tomography (PET) image or a single positron emission computed tomography (SPECT) image, which method includes:

a. acquiring further images that represent the object in at least two of the states of motion with as few motion artifacts as possible, the further images being one of computed tomography (CT) images and magnetic resonance (MR) images;

b. from the further images, determining a motion model that characterizes the states of motion assumed by the object while the projections are acquired;

c. forming additional images of others of the states of motion of the object from the further images and the motion model;

d. weighting and subsequently superimposing the other images and the second modality images in conformity with a frequency at which each of the other states of motion were assumed by the object while moving over the range of motion at which the first modality image data was acquired;

e. forming at least one intermediate image of the object from the motion model and the further images, the at least one intermediate image representing one or more of the states of motion assumed by the object while the projections are acquired;

f. reconstructing the first image from the projections of the object and the at least one intermediate image.

4. (Previously Presented) The method as claimed in claim 1, wherein determining the motion model includes:

determining a respective motion vector field for parts of the object.

5. (Cancelled)

6. (Previously Presented) The method as claimed in claim 1, further including:

elastically registering the intermediate image and the first modality image prior to the formation of the combination image.

7. (Previously Presented) The method as claimed in claim 1, further including:

focusing the combination image.

8. (Previously Presented) The method as claimed in claim 2, further including:

registering the focused image and at least one of the further images; and

forming a combination image from the focused first image and the at least one of the further images.

9. (Cancelled)

10. (Previously Presented) An image processing system which includes a data processing unit for carrying out the method as claimed in claim 1.

11. (Previously Presented) A medical examination apparatus, the apparatus including:

a device for forming images or projections by means of a first imaging method;

a second device for forming images or projections by means of a second imaging method;

an image processing system that includes a data processing unit for carrying out the method as claimed in claim 1.

12. (Previously Presented) A computer readable medium containing instructions for controlling a data processing unit in such a manner that the data processing unit can carry out the method as claimed in claim 1.

13. (Previously Presented) The method as claimed in claim 2, wherein determining the motion model includes:

determining a respective motion vector field for parts of the object.

14. (Previously Presented) The method as claimed in claim 3, wherein determining the motion model includes:

determining a respective motion vector field for parts of the object.

15-17. (Cancelled)

18. (Cancelled)

19. (Currently Amended) A method of motion compensation comprising:

acquiring a first sequence of image data of a moving object by a first imaging modality data acquisition system, the first imaging modality data acquisition system including one of a positron emission tomography (PET) system and a single positron emission computed tomography (SPECT) system;

acquiring a second sequence of image data of the moving object by a second imaging modality data acquisition system, the second imaging modality data acquisition system including a computer tomography (CT) system, an ultrasound system, or a fast magnetic resonance (MR) tomography system;

determining a motion model related to periodic motion of the object based on the second sequence of image data;

forming other images of other states of motion of the object from the second modality image data;

weighting and subsequently superimposing the other images and the second modality images in conformity with a frequency at which each of the other states of motion were assumed by the object while moving over the range of motion while the first modality image data was acquired;

using the determined motion model, generating from the first sequence of image data a first modality image data set in a selected motion state.

20. (Previously Presented) The method as claimed in claim 19, further including:

generating a combined image data set in the selected motion state from the first modality image data set and a second modality image data set in the selected motion state.

21. (Cancelled)

22. (Cancelled)

23. (Previously Presented) The method as claimed in claim 19, further including:

registering coordinates systems of the first and second imaging modality data acquisition systems.

24. (Cancelled)

25. (Previeously Presented) The method as claimed in claim 19, further including:

sensing motion of the object at least during acquisition of the second sequence of imaging data.

26. (Previously Presented) The method as claimed in claim 25, wherein the sensed motion is a cyclic motion in which the object cyclically assumes each of a plurality of motion states.

27. (Previously Presented) The method as claimed in claim 19, wherein the motion model includes a motion vector field which indicates movement between at least two motion states.

28. (Currently Amended) An imaging system comprising:

a first imaging modality data acquisition system for generating a first imaging modality sequence of image data, the first imaging modality being one of PET and SPECT;

a second imaging modality data acquisition system for generating a second imaging modality sequence of image data, the second imaging modality being one of computed tomography ultrasound, and magnetic resonance;

a motion sensor for sensing object motion;

a processor programmed to:

reconstruct the first modality image data into a motion artifacted first modality image;

reconstruct the second modality image data into second modality images which represent the object in respective states of motion with as few motion artifacts as possible;

from the second modality images, determine a motion model which characterizes states of motion assumed by the object while moving through the states of motion;

form an intermediate image of the object from the motion model and the second modality images, the intermediate image representing the object as if it had moved during the acquiring of the second modality image data over the range of motion over which the object moved as the first modality imaging data was acquired, forming the intermediate image including:

forming other images of other states of motion of the object from the second modality image data,

weighting and subsequently superimposing the other images and the second modality images in conformity with a frequency at which each of the other states of motion were assumed

by the object while moving over the range of motion while the first modality image data was acquired;

form a combination image from the intermediate image and the first modality image.

29. (Previously Presented) The imaging system as claimed in claim 28, wherein the motion model characterizes motion states assumed by the object while moving among a plurality of motion states.

30. (Previously Presented) The imaging system as claimed in claim 28, further including:

operating mathematically with the motion model to transform the first imaging modality image data to a selected motion state.

31-34. (Cancelled)

Allowable Subject Matter

[4] **Claims 1-4, 6-8, 10-14, 19, 20, 23** and **25-30** allowed.

[5] The following is a statement of reasons for the indication of allowable subject matter:

Regarding **claim 1**, while the prior art of record teaches acquiring first and second modality image data and reconstructing the second modality image data into second modality images which represent the object in respective states of motion with as few motion artifacts as possible, from the second modality images, determining a motion model which characterizes states of motion assumed by the object while moving through the states of motion,

the prior art of record does not teach doing so while including the first modality image being one of PET or SPECT and the second modality image being one of CT or MR, in addition

to weighting and subsequently superimposing the other images and the second modality images in conformity with a frequency at which each of the other states of motion were assumed by the object while moving over the range of motion while the first modality image data was acquired.

Claims 2-3, 19, and **28** allowed by analogy. **Claims 4, 6-8, 10-14, 20, 23, 25-27,** and **29-30** allowed by dependency.

§ 101 Positive Statement

[6] Regarding **claims 1,-3, 10,** and **19,** the method claims in question are (i) closely tied to computer processor based on inherency (the specification is drawn to the use of a computer program and internal memory which would inherently be tied to a processor to carry out the method steps); and (ii) transforming an article to a different state of thing (e.g., the patient's diaphragm is being transformed to image data for use in the method steps).

Conclusion

Citation of Pertinent Prior Art

[7] The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. US 5647360 A; US 5690106 A; US 6341179 B1; US 6490476 B1; US 20030004405 A1.

[8] Any inquiry concerning this communication or earlier communications from the examiner should be directed to DAVID P. RASHID whose telephone number is (571)270-1578 and fax number (571)270-2578. The examiner can normally be reached Monday - Friday 7:30 - 17:00 ET.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached on (571) 272-7453. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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